

[54] **INTEGRATED HELMET AND MASK
STRUCTURE**[75] Inventors: **William K. Ansie, Glendale; John J. Mitchell, Jr., Arcadia, both of Calif.**[73] Assignee: **Sierra Engineering Company, Sierra Madre, Calif.**[22] Filed: **May 22, 1972**[21] Appl. No.: **255,838**[52] U.S. Cl. **2/6, 128/142**[51] Int. Cl. **A62b 7/00**[58] Field of Search **128/141, 142, 146.7, 142.3,
128/142.2, 142.5; 2/6**[56] **References Cited****UNITED STATES PATENTS**

2,005,072	6/1935	Booharin.....	128/141 R
2,882,896	4/1959	Seeler	128/142.2
3,128,469	4/1964	Lobelle	2/6
3,330,274	7/1967	Bennett.....	128/146.7
3,473,166	10/1969	Lobelle	128/142.7
3,624,663	11/1971	Jones	128/142.7

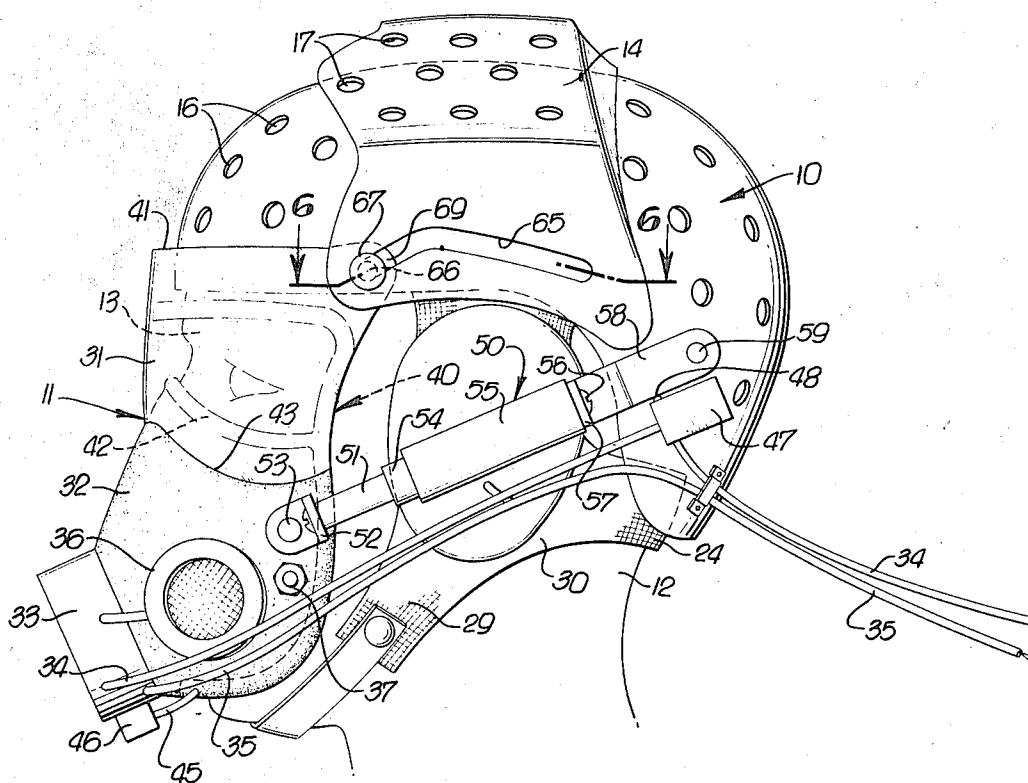
FOREIGN PATENTS OR APPLICATIONS

815,498 6/1959 Great Britain

996,207 12/1951 France

Primary Examiner—Richard A. Gaudet*Assistant Examiner*—G. F. Dunne[57] **ABSTRACT**

For flying personnel there is provided a hard shell helmet suitably padded and held out of close contact with the head. An integrated visor assembly has an articulated attachment to the helmet movable between an operative position over the wearer's face and a lifted position extending over the top of the helmet removed from the face. Compound leverage elements making up the attachment determine a path of movement for the visor assembly such that it travels an irregular path allowing it to first lift clear of contact with the face and then travel upwardly to its lifted position. An inflatable seal extends around the perimeter of the visor assembly, the seal being inflated with air from the oxygen supply for the breathing mask when in operation over the face of the wearer and being collapsed when deflated providing additional clearance for ease of removal from the face and for storage in its lifted position.

9 Claims, 13 Drawing Figures

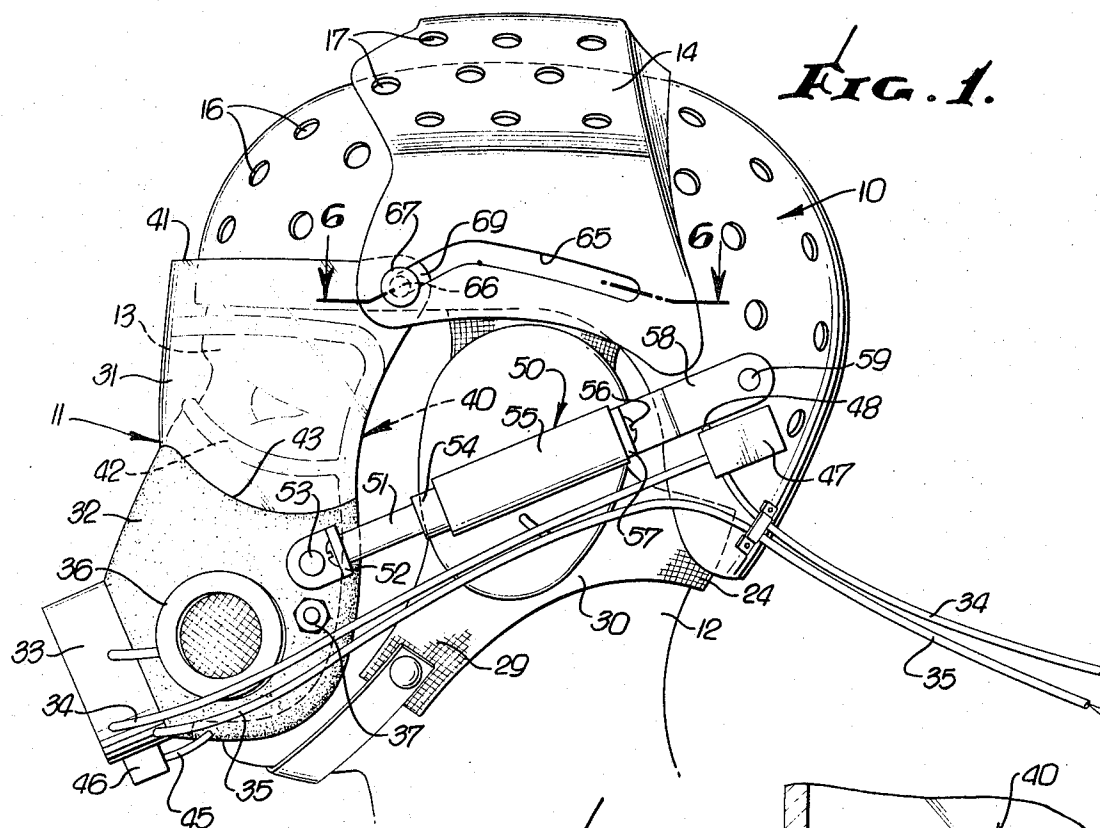


FIG. 1.

FIG. 2.

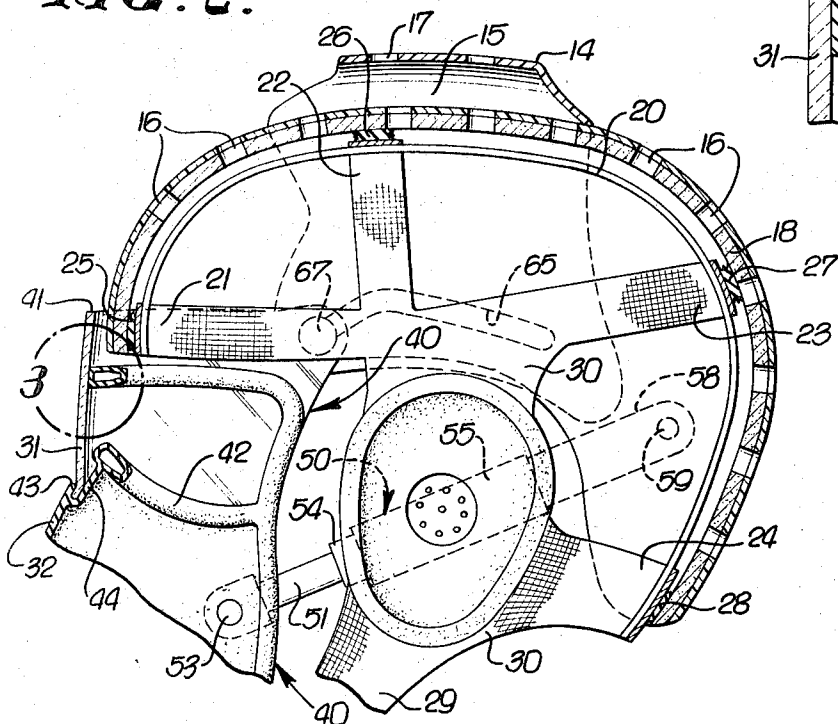


FIG. 3.

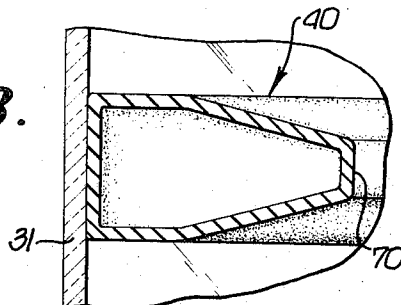


FIG. 4.

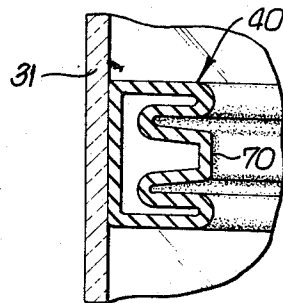


FIG. 5.

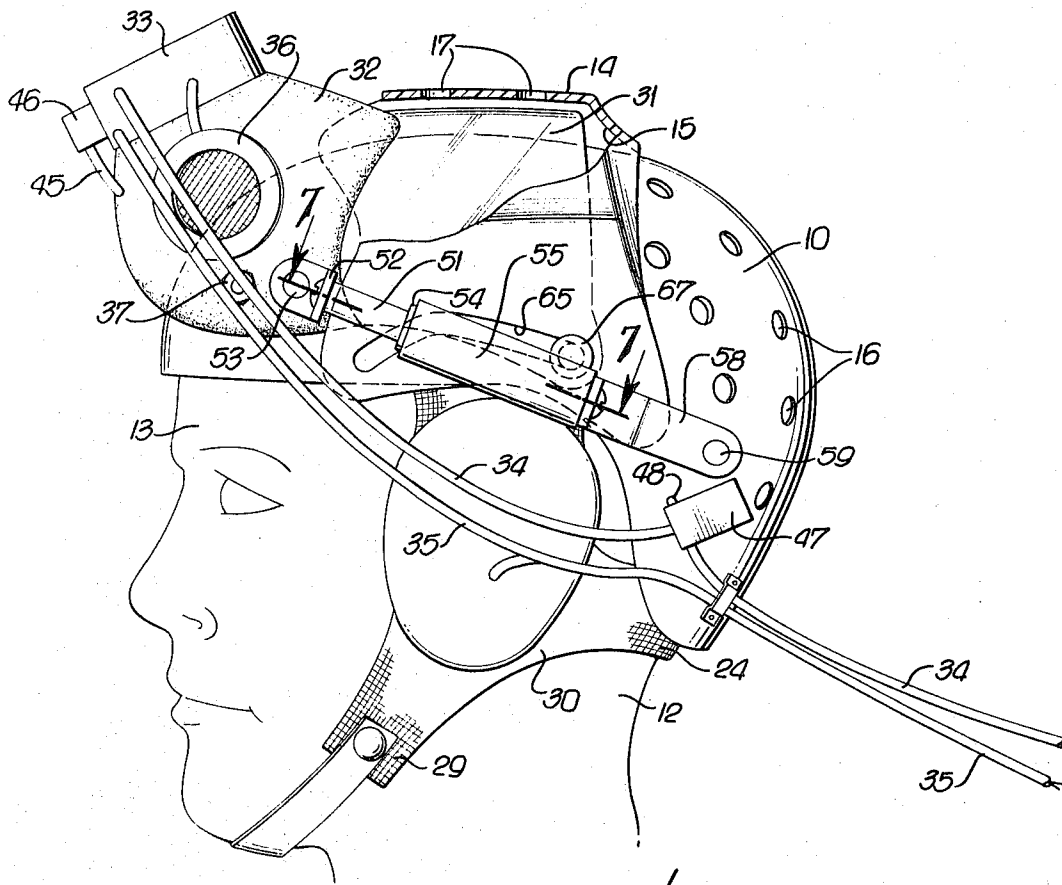


FIG. 6.

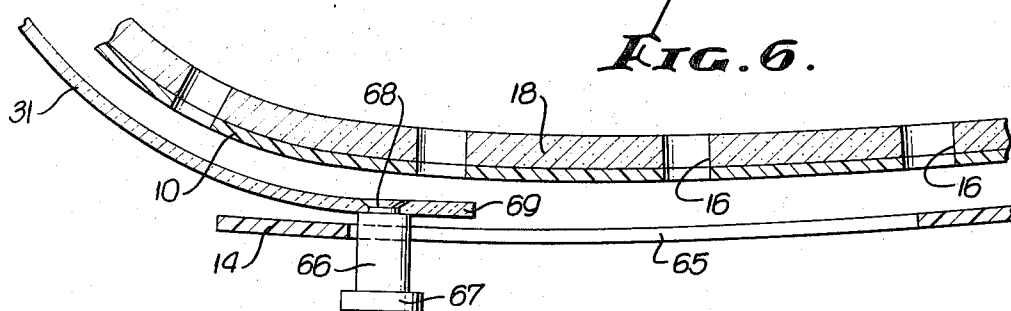


FIG. 7.

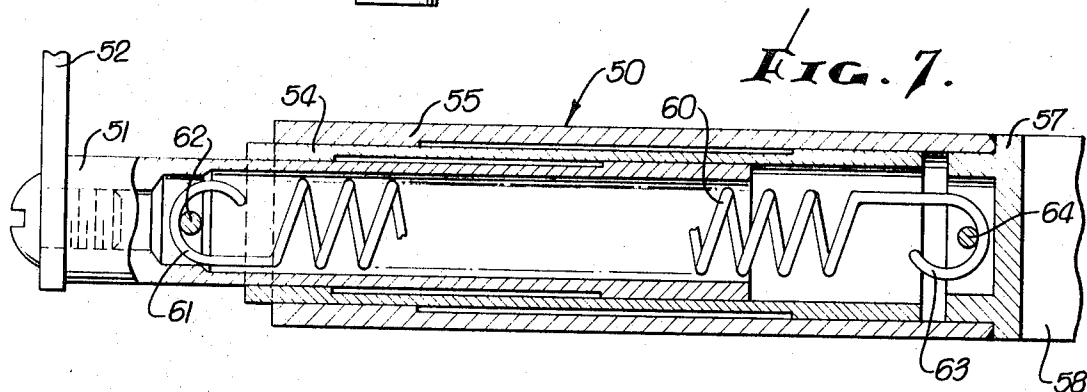


FIG. 8.

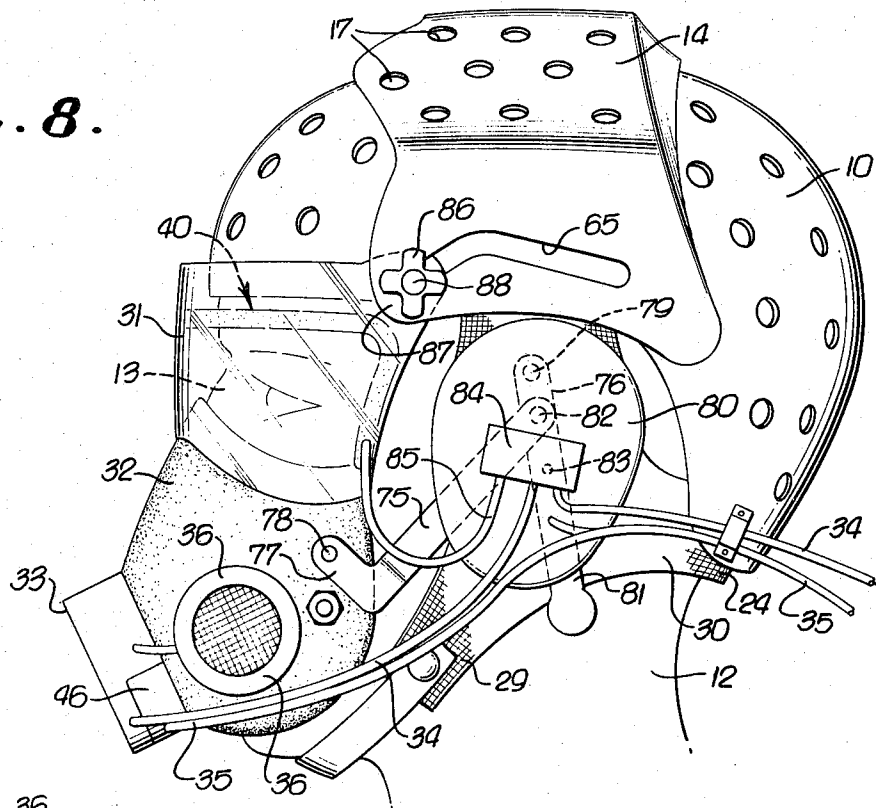


FIG. 9.

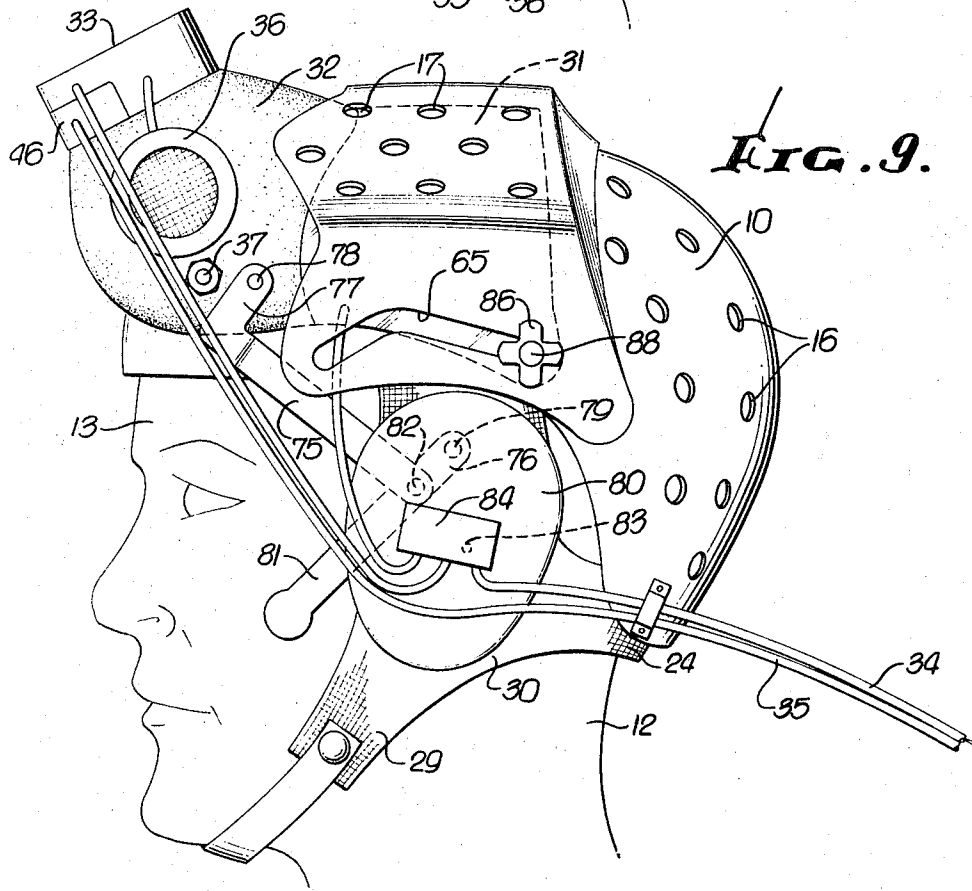


FIG. 10.

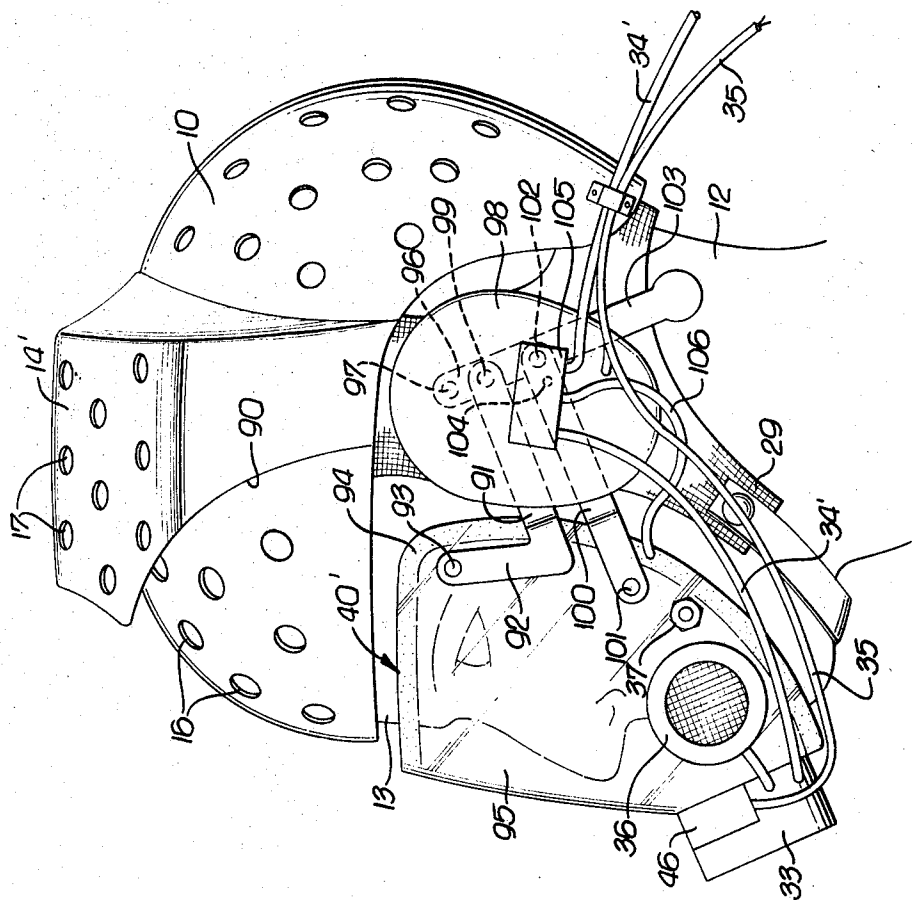


FIG. 11.

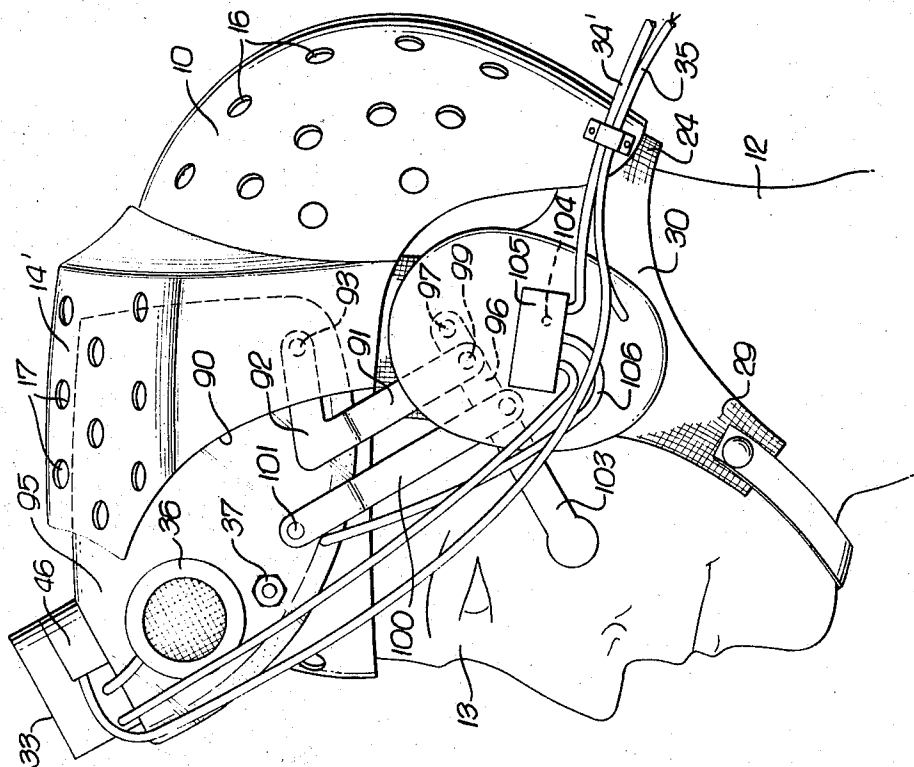


FIG. 12.

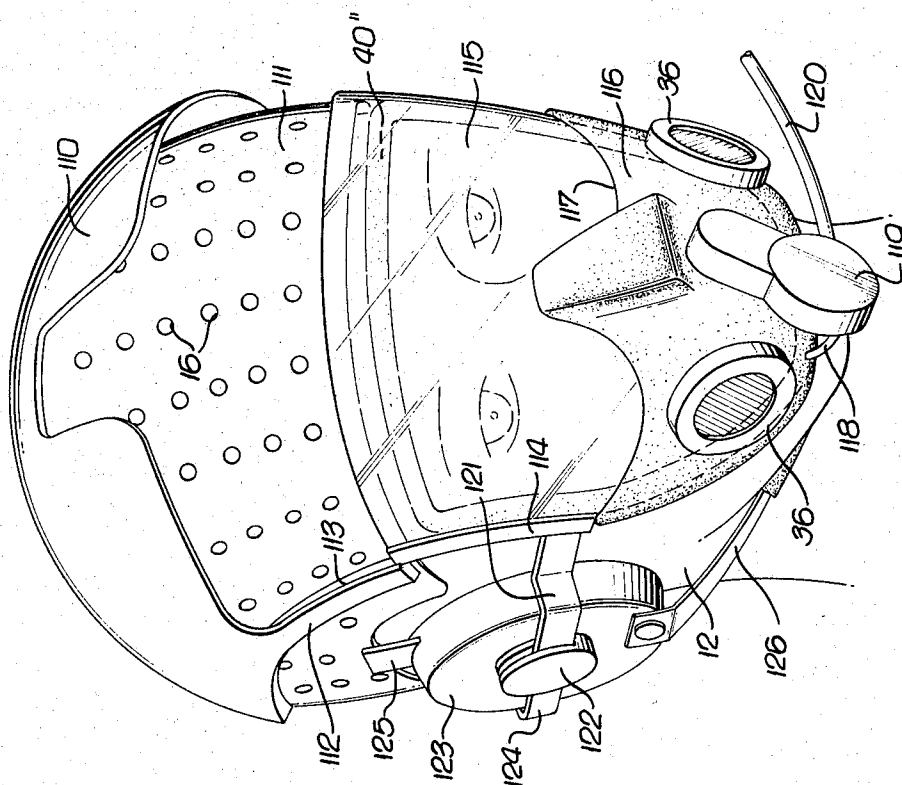
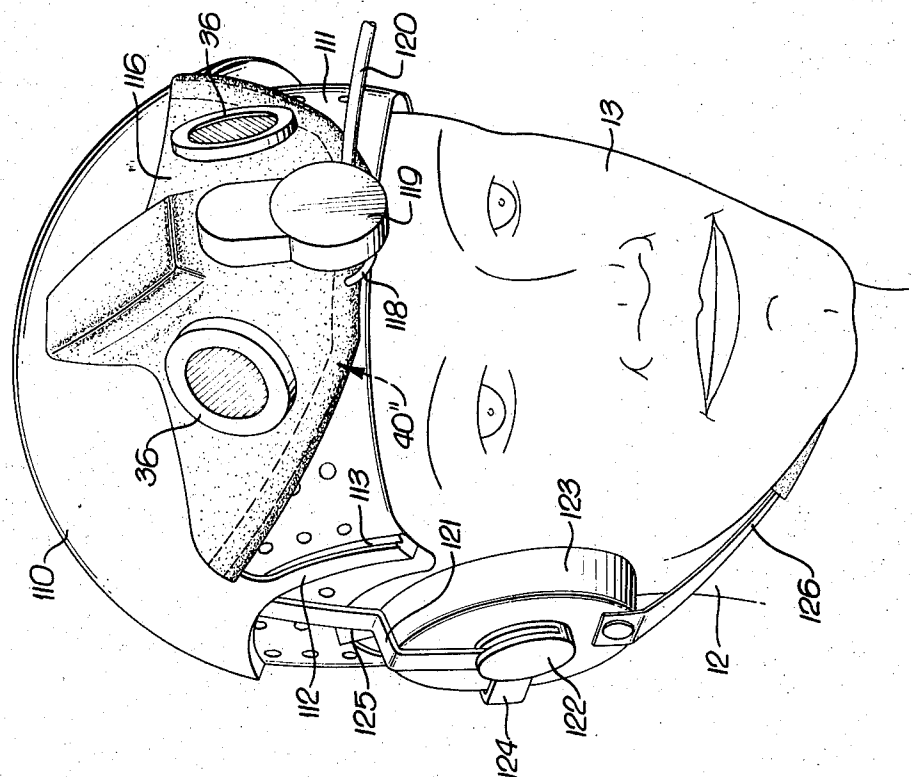


FIG. 13.



INTEGRATED HELMET AND MASK STRUCTURE

As aircraft capabilities continuously involve increased speeds, demands upon the men who fly them experience a change which, in part, adds greatly to the mental and physical stresses experienced. Physical discomforts are variable in nature and additive. Movement within the cockpit is confined and restricted. Added to this is the weight and restrictiveness of equipment worn by the pilot and crew and the heat generated within his personal flight safety equipment which, over long periods of flight duty, create extensive discomfort. Personal flight equipment can be said to comprise chiefly of a flight protection helmet equipped with oxygen mask, head-set or ear phones and a smoke-protective visor.

Respecting currently available personal equipment, a complaint and consequently a defect in addition to being too hot, too heavy, excessively cumbersome and too restrictive, is that the equipment has too many non-integrated components. Whatever remedy may be offered, however, the protection must still include protection against head injury as a result of buffeting or turbulence upon ejection, cabin or cockpit decompression, either explosive or otherwise, and eye protection from the smoke of cabin or cockpit fires as well as from spalling.

It is therefore among the objects of the invention to provide a new and improved helmet and mask integrated structure wherein the mask and communication equipment are so connected to the helmet itself to present a more integrated combination which, at the same time, is cool and comfortable when worn.

Another object of the invention is to provide a new and improved helmet and mask integrated structure which is low in profile despite the need for a leverage or related mechanism to permit the mask assembly to be removed from the face.

Still another object of the invention is to provide a new and improved helmet and mask integrated structure provided with an inflatable seal between the mask assembly and the face of the wearer which can, when desired, be inflated automatically by oxygen pressure normally supplied to the mask and which provides for sufficient mask clearance of the face during donning.

Still further among the objects of the invention is to provide a mask assembly including an inflatable seal which is of such design and construction that it can be readily fitted to faces of different shape and size without need for changing the shape and size of the mask assembly and associated helmet shell.

With these and other objects in view, the invention consists in the construction, arrangement, and combination of the various parts of the device, whereby the objects contemplated are attained, as hereinafter set forth, pointed out in the appended claims and illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a side elevational view of one form of the helmet and mask integrated structure shown in operative position on the head of a wearer.

FIG. 2 is a longitudinal sectional view of the structure of FIG. 1.

FIG. 3 is a fragmentary cross sectional view taken on the circular line 3 of FIG. 2 with the seal inflated.

FIG. 4 is a fragmentary sectional view similar to FIG. 3 but with the seal deflated.

FIG. 5 is a side elevational view similar to FIG. 1 but with the visor assembly lifted into inoperative position.

FIG. 6 is a fragmentary cross sectional view on the line 6—6 of FIG. 1.

FIG. 7 is a fragmentary longitudinal sectional view on the line 7—7 of FIG. 5.

FIG. 8 is a side elevational view of a second form of the invention shown in position on the head of a wearer.

FIG. 9 is a side elevational view of the same form of the device as in FIG. 8 but with the visor assembly lifted into inoperative position.

FIG. 10 is a side elevational view of another form of the device shown in operative position.

FIG. 11 is a side elevational view of the device of FIG. 10 but with the visor assembly lifted into inoperative position.

FIG. 12 is a front perspective view of a modified form of the invention as shown in operative position on the head of a wearer.

FIG. 13 is a front perspective view similar to FIG. 12 but with the visor assembly lifted into inoperative position.

In an embodiment of the invention chosen for the purpose of illustration, there is shown a hard helmet shell 10 equipped with a visor assembly indicated generally by the reference character 11 shown mounted on the head 12 of a wearer with the visor assembly in operative position applied into the wearer's face 13. A visor cover 14 is fixed in position at the crown of the helmet shell and provides a pocket 15. Extending through the helmet shell is a series of ventilating perforations 16, and perforations 17 in the visor cover assist the perforations 16 which open into the pocket 15. Perforations serve two functions; to provide for ventilation; to reduce weight, yet still provide protection. A shock or energy absorbing liner 18 extends around the entire inner surface of the helmet shell, the liner being of some appropriate foam cushion.

For supporting the helmet shell and perforce the helmet and mask integrated structure on the crown of the head 12, there is provided a sling 20 extending fore and aft and to which are applied a forehead cross-web 21, a crown cross web 22, a rear cross-web 23 and a nape cross-web 24 attached to the sling at the junctions shown. The sling and cross-webs are provided with elastomer pads 25, 26, 27 and 28 of appreciable depth sufficient to support the helmet shell in a position removed from contact with the head of the wearer providing a space from which heat from the wearer's head can pass outwardly through the perforations 16. A chin strap 29 serves to hold the sling and cross-webs in position, the chin strap and the cross-webs being all attached to a lateral webbing 30 surrounding the wearer's ears.

It will be understood that the lining of the helmet shell normally is spaced clear of the head of the wearer and that this spacing may vary to some extent depending upon the shape of the wearer's head and the height of the elastomer pads. The pads, moreover, are yieldable and the sling and cross-webs are likewise yieldable so that should there be an impact on the helmet shell sufficient to compress the pads at one location or another, the wearer's head will strike the liner. The liner is of a character capable of absorbing the impact and

the energy is dissipated, thereby protecting the head of the wearer.

It should be noted that the attachment of the ear cups to the helmet is flexible to allow lateral spreading to clear ears for rapid donning. These flexible attachments facilitate folding ear cups into the inside of helmet shell for minimum storage volume.

The visor assembly 11 in this embodiment consists of two parts, namely, an eye area shell section 31 at a location surrounding the eyes of the wearer and an oral-nasal area shell section 32 which is the portion usually identified as a breathing mask and upon which is mounted a regulator 33 capable of accommodating appropriate valving (not shown) for an air or oxygen line 34 and a microphone (not shown) supplied by a microphone line 35.

In this embodiment there is also provided a compensated exhalation valve 36 and a relief valve 37 of substantially conventional construction.

For sealing the perimeter of the visor assembly to the face 13 of the wearer, use is made of a seal indicated generally by the reference character 40 which in the chosen embodiment is a hollow tube, as indicated in FIGS. 3 and 4. As shown in FIGS. 1 and 2, the tube extends around the lower and side edges of the oral-nasal area shell section 32, the side edges of the eye area shell section 31 and across the upper or forehead portion of the eye area shell section 31 at a location slightly removed from an upper edge 41. To the extent described, the seal is continuous and endless. In addition, there is a transverse section 42 of the seal which extends across the eye area shell section near the line 43 of junction between the eye area shell section and the oral-nasal area shell section. As shown in FIG. 2, the transverse section 42 is actually attached to a web 44 which lies inside of the eye area shell section 31. The transverse section, moreover, is in communication with the seal 40 at the point of junction.

For inflating the seal, use is made of an air line 45, shown in FIG. 1, which extends from an air switch 46 supplied in turn from the mask regulator 33.

In the air or oxygen line 34 is interposed an air valve 47 on which is an actuator button 48 which normally tends to move to a shutoff position. As shown in FIG. 1, the actuator button is moved to an "on" position by engagement therewith of a portion of a composite arm 50. A microphone switching arrangement also might be incorporated to switch "off" an external microphone (boom microphone) and switch on the microphone inside the mask.

As shown in FIG. 7 in company with FIG. 1, the composite arm consists of a plunger 51, an outer end of which is attached to a bracket 52 which, in turn, has a pivotal attachment 53 to the side of the oral-nasal area shell section 32.

A telescoping sleeve 54 forms a connection between the plunger 51 and a hollow cylinder 55. The cylinder is in turn attached by means of a screw 56 to a bracket 57, the bracket being part of an arm 58 which has a pivotal attachment 59 to the helmet shell 10.

As shown in FIG. 7, a spring 60 has one end 61 secured by a spring keeper 62 to the plunger 51 and has its other end 63 secured to a keeper 64 which is anchored to the bracket 57. The spring under tension is biased to draw the visor assembly in a direction from left to right as viewed in FIG. 1 so that the seal 40 is

drawn into engagement with the face 13 of the wearer.

To assist in shifting the visor assembly 11 from the operative position shown in FIG. 1 to the withdrawn position of FIG. 5, use is made of a slot 65 in the visor cover 14 within which travels the shank 66 of a knob 67, the shank 66 being riveted at 68 to an adjacent edge 69 of the eye area shell section 31.

Although only one side of the visor assembly is shown in FIG. 1, it will be understood that the other side is identical except for being a right-hand side counterpart of the composite arm 50 and the slot 65 containing the shank 66. Connected as described, the visor assembly and helmet shell are an integrated structure in that, except for the upward and downward motion about the pivot joints, the visor assembly is firmly held in a fixed relationship with respect to the helmet shell.

When the visor assembly is to be moved from the operative position of FIG. 1 to the elevated position of FIG. 5, the mask regulator, protruding as it does, can be made use of in a sense as a handle when the visor assembly is lifted upwardly or counter clockwise as viewed in FIG. 5.

When this occurs, the arm 58 is moved from its position of engagement with the actuator button 48 and the air valve 47 then closes off the air line 34 so that no air flows either to the mask regulator 33 or to the seal 40 through the air line 45.

When this circumstance prevails, the seal 40 will collapse to the position shown in FIG. 4 by reason of the fact that the seal initially is given the collapsed form of FIG. 4 when molded. Collapsing as described, a sealing face 70 has a seal 40, which is the portion of the seal which actually engages the skin on the face 13 and draws away from the skin an appreciable distance, namely, about half the inflated height of the seal as shown in FIGS. 3 and 4. This provides adequate clearance so that when the mask assembly is lifted progressively from the position of FIG. 1 to the position of FIG. 5, there will be no resistance to its lifting. Additionally, when the mask assembly is elevated, the composite arm 50 then in an over-center position functions to pull the visor assembly toward the visor cover 14 until the eye area shell section is drawn into the pocket 15.

Conversely when the mask assembly is to be lowered into operating position, the mask regulator 33 and visor assembly is swung downwardly or counter-clockwise as viewed in FIG. 5, initially extending the spring 60 as it swings, until the positions of FIG. 1 are then accomplished. At this point the arm 58 engages the actuator button 48 thereby to admit automatically air from the air or oxygen line 34 to the mask regulator 33 and thence into the mask. At the same time, air under pressure passes through the air switch 46 and air line 45 into the seal 40 causing it to be inflated to the position of FIG. 3. In this position the sealing face 70 will be drawn gently into engagement with the face of the wearer thereby sealing all of that portion of the visor assembly which is defined by the perimeter of the seal as shown in FIGS. 1, 2 and 5.

In the form of invention of FIGS. 8 and 9, there is substituted for the composite arm 50 a compound lever assembly consisting of a lever arm 75 and lever arm 76. The lever arm 75 has a bent end section 77 extending at right angle to the lever arm, the end section 77 having a pivot connection 78 to the edge of the oral-nasal area shell section 32.

The lever arm 76 has a pivot connection 79 to an ear receptacle 80 which is an integral part of the helmet shell 10. An extension 81 of the lever arm 76 protrudes below the ear receptacle and there is a pivot connection 82 between the lever arm 75 and the lever arm 76 at a location not far removed from the pivot connection 79. An actuator button 83 on an air valve 84 serves to automatically open the air valve when the extension 81 is in the position shown in FIG. 8 thereby to inflate the seal 40 while the visor assembly is in a position against the face 13 of the wearer.

Conversely when the visor assembly is lifted to the position of FIG. 9, the extension 81 moves out of engagement with the actuator button 83 thereby permitting the air valve to close and cut off the air supply whereupon the seal 40 collapses in the manner previously described. In this form of invention, an air line 85 extends from the air valve 84 to a side portion of the seal 40 as shown in FIG. 8.

When the visor assembly is in the operating position of FIG. 8 and the wearer wishes to press it more snugly against his face, the extension 81 can be employed to help tighten the seal by pushing rearwardly against the extension. When it has been pushed far enough, a locking button 86, of substantially conventional construction, can be turned to tighten engagement of a corner tab 87 of the eye area shell section 31 to the visor cover 14 which is immediately adjacent the end of the slot 65.

When the visor assembly is to be lifted clear of the face the locking button 86 is loosened. The visor assembly can then be lifted to the position of FIG. 9. Meanwhile the locking button and its attached shank 88 move to the opposite end of the slot 65 and there again can be tightened so as to be capable of holding the visor assembly in the elevated position until it is to be released.

Additionally, this engagement of the extension 81 from the actuator button 83 causes the air valve 84 to shut off the supply of air and the seal 40 thereupon will collapse.

In the form of invention of FIGS. 10 and 11, the visor cover 14' is cut away at 90 and the slot 65 dispensed with. A lever system of three lever arms is made use of for holding and guiding the visor assembly relative to the helmet shell. The lever system consists of a lever arm 91 having a bent section 92 at one end which by means of a pivot connection 93 is attached to a corner 94 of a transparent visor 95. A lever arm 96 has a pivot connection 97 to an ear receptacle 98 which is an integral part of the helmet shell 10. A pivot connection 99 interconnects the lever arm 91 with the lever arm 96.

Another lever arm 100 has a pivot connection 101 at one end to the visor 95 about midway between the top and the bottom. At the other end of the lever arm is a pivot connection 102 which connects the lever arm 100 to the lever arm 96 at a location farther away from the pivot connection 97 than the pivot connection 99 previously described. An extension 103 of the lever arm 96 protrudes to a position below the ear receptacle 98.

An actuator button 104 on an air valve 105 serves a function similar to the previously described actuator button 83 in that in the lowered or operative position of FIG. 10, the actuator button 104 is tripped by the lever arm 100 and causes the air valve to open thereby to inflate a seal 40'. When the visor assembly is lifted

to the position of FIG. 11, the lever arm 100 is moved free of the actuator button 104 causing it to shut off the supply of air whereupon to collapse the seal 40'.

In this form of the invention the visor 95 is substantially a single piece transparent visor which covers the surface of the wearer's face 13 both above and around the eyes and around and below the nose and mouth. In this way a single perimetrical seal 40' extending around the edge of the visor 95 forms a seal between the visor and the face of the wearer. An air line 106 communicates between the air valve 105 and the seal 40' so that air from an air or oxygen line 34' can be made to supply both air pressure for the seal 40' and air to the mask regulator 33 which communicates with the area beneath the visor 95 in a substantially conventional manner.

A somewhat different form of helmet and mask integrated structure is shown in FIGS. 12 and 13. There a visor cover 110 mounted on a helmet shell 111 is provided with a pair of forwardly extending extensions 112 in each of which is a track 113. A shoe 114 on either side of an eye area shell section 115 is curved to match the curvature of the track 113 and is adapted to slide with respect to the track as the eye area shell section is moved upwardly from the position in FIG. 12 to the position of FIG. 13. A mask section 116 adapted to extend around the nose and mouth of the wearer is integrally attached to the eye area shell section along the line 117.

A seal 40'' of the same general character as the seals 40 and 40' heretofore described, extends around the perimeter of the eye area shell section 115 and the mask section 116, the seal being supplied with air through an air line 118 fed from a mask regulator 119. The mask regulator is in turn supplied by an air line 120.

To additionally hold and guide the eye area shell section and hence what constitutes a mask assembly, there is provided a pair of lift arms 121, one on each side, one only being shown in FIGS. 12 and 13. The lift arm 121 is pivoted beneath a pivot connection 122, the pivot connection being mounted upon and anchored to an ear receptacle 123.

The ear receptacle 123 is made to act substantially integrally with the helmet shell 110 by employment of a rear strap 124 and an upper strap 125. The straps may be either a synthetic plastic resin material or a spring metal material which by flexing in the direction of the flat areas permits the ear receptacles to be easily moved upwardly away from the head and ears of the wearer when the helmet is to be donned and which, upon release, will cause the ear receptacles to be sprung inwardly into contact with the area around the ears of the wearer by virtue of the return acting spring effect of the straps 124 and 125. A chin strap 126 helps hold the assembly in place.

Here, again, except for the movement up and down of the visor and mask combination relative to the helmet shell, the helmet shell and the visor and mask combination have only very limited movement in any other direction thereby making them a substantially integrated structure, which fits under the visor cover 110 when elevated to the position of FIG. 13, and which snugly seals around the face of the wearer in the position of FIG. 12.

While the invention has herein been shown and described in what is conceived to be a practical and effective

tive embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices.

Having described the invention, what is claimed as new in support of Letters Patent is:

1. An integrated helmet and mask structure for the head and face of a wearer comprising a hard helmet shell, a visor assembly having an articulated attachment on each side to the helmet shell, each said articulated attachment comprising a first moving connection between the helmet shell and an upper end of the visor assembly determinative of a first path of movement of the visor assembly relative to the helmet shell and a second moving connection between the helmet shell and the lower end of the visor assembly determinative of a second path of movement of the visor assembly relative to the helmet shell, said visor assembly comprising an eye area shell section adapted to surround the eyes of the wearer and an oral-nasal area shell section adapted to surround the mouth and nose of the wearer, and a visor cover on the upper portion of the helmet shell forming a space beneath itself and the helmet shell for reception of the eye area shell section when the visor assembly is raised to a position clearing the face of the wearer, said first moving connection comprising means forming a slot in the visor cover and a pivot pin on the eye area shell section and located in said slot, said pivot pin having a pivoting and sliding connection to said visor cover.

2. An integrated helmet and mask structure for the head and face of a wearer comprising a hard helmet shell, a visor assembly having an articulated attachment on each side to the helmet shell, each said articulated attachment comprising a first moving connection between the helmet shell and an upper end of the visor assembly determinative of a first path of movement of the visor assembly relative to the helmet shell and a second moving connection between the helmet shell and the lower end of the visor assembly determinative of a second path of movement of the visor assembly relative to the helmet shell, said visor assembly comprising an eye area shell section adapted to surround the eyes of the wearer and an oral-nasal area shell section adapted to surround the mouth and nose of the wearer, and a visor cover on the upper portion of the helmet shell forming a space beneath itself and the helmet shell for reception of the eye area shell section when the visor assembly is raised to a position clearing the face of the wearer, said first moving connection comprising means forming a slot in the visor cover and a pivot pin on the eye area shell section and located in said slot, said pivot pin having a pivoting and sliding connection to said visor cover, said second moving connection comprising an arm, one end of said arm having a pivotal attachment to the oral-nasal shell area shell section, and the other end of said arm having a pivotal attachment to the helmet shell.

3. An integrated helmet and mask structure as in claim 2 wherein said arm is longitudinally extendable and includes spring means biased to retract said arm whereby to pull said shell sections against the face of the wearer.

4. An integrated helmet and mask structure for the head and face of a wearer comprising a hard helmet shell, a visor assembly having an articulated attachment

on each side to the helmet shell, each said articulated attachment comprising a first moving connection between the helmet shell and an upper end of the visor assembly determinative of a first path of movement of the visor assembly relative to the helmet shell and a second moving connection between the helmet shell and the lower end of the visor assembly determinative of a second path of movement of the visor assembly relative to the helmet shell, said visor assembly comprising an eye area shell section adapted to surround the eyes of the wearer and an oral-nasal area shell section adapted to surround the mouth and nose of the wearer, and a visor cover on the upper portion of the helmet shell forming a space beneath itself and the helmet shell for reception of the eye area shell section when the visor assembly is raised to a position clearing the face of the wearer, said first moving connection comprising means forming a slot in the visor cover and a pivot pin on the eye area shell section and located in said slot, said pivot pin having a pivoting and sliding connection to said visor cover, said second moving connection comprising a pair of lever arms, one end of one of said arms having a pivotal attachment to the oral-nasal area shell section, one end of the other of said arms having a pivotal attachment to the helmet shell, said arms having a pivotal joint therebetween.

5. An integrated helmet and mask structure as in claim 4 wherein one of said arms has an extension extending beyond said pivotal joint to a location removed from the helmet shell and accessible to the wearer for manipulation of the position of said visor assembly.

6. An integrated helmet and mask structure for the head and face of a wearer comprising a hard helmet shell, a visor assembly having an articulated attachment on each side to the helmet shell, each said articulated attachment comprising a first moving connection between the helmet shell and an upper end of the visor assembly determinative of a first path of movement of the visor assembly relative to the helmet shell and a second moving connection between the helmet shell and the lower end of the visor assembly determinative of a second path of movement of the visor assembly relative to the helmet shell, the connection between the helmet shell and the lower end of the visor assembly being separate from and at a location remote from the connection of the upper end of the visor assembly to the shell, said first moving connection comprising a first lever arm with a pivotal connection between one end of said first arm and an upper portion of the visor assembly, a second lever arm with a pivotal connection between one end of said second lever arm and a lower portion of the visor assembly, and a third arm with a pivotal connection between one end of said third arm and the helmet shell, other ends respectively of said first and second lever arms having pivotal connections to the third lever arm at spaced locations thereon.

7. An integrated helmet and mask structure as in claim 6 wherein said third lever arm has an extension extending beyond the pivotal connections respectively to said first and second lever arms whereby to enable manipulation of said visor assembly by the wearer.

8. An integrated helmet and mask structure for the head and face of a wearer comprising a hard helmet shell, a visor assembly having an articulated attachment on each side to the helmet shell, each said articulated attachment comprising a first moving connection between the helmet shell and an upper end of the visor as-

sembly determinative of a first path of movement of the visor assembly relative to the helmet shell and a second moving connection between the helmet shell and the lower end of the visor assembly determinative of a second path of movement of the visor assembly relative to the helmet shell, said helmet shell comprising a head receiving receptacle and ear receiving receptables, said first moving connection comprising a track on the helmet shell and a sliding shoe on the visor assembly in sliding engagement with said track, said second moving connection comprising an arm with a pivotal connection between one end of said arm and the helmet shell

and a fixed connection between the other end of said arm and the visor assembly.

9. An integrated helmet and mask structure as in claim 8 wherein there is a stiff band interconnecting each ear receiving receptacle and the head receiving receptacle at the rear portion of said head receiving receptacle, and a relatively stiff band interconnecting the ear receiving receptacle and the head receiving receptacle at the side portion of said head receiving receptacle, and wherein the pivotal connection of said arm is a connection to the ear receiving receptacle.

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